## REMARKS

Applicants note with appreciation the indication of allowable of subject matter by the Examiner, specifically, the subject matter recited in Claims 5, 6, 7, 11, 18, 23, 24, 25, 29, and 30. With this Response Applicants add new Claim 31. Now in the application are Claims 1-31 of which Claims 1, 13, 19, and 31 are independent. New Claim 31 presents no new matter and no new issues are raised. The following comments address all stated grounds for rejection and place the presently pending claims as identified above, in condition for allowance.

## CLAIMS REJECTIONS UNDER 35 U.S.C. §102

Claims 1-4, 9, 10, 13, 14, 16, 17, 19-22, 27, and 28 stand rejected under 35 U.S.C. §102(e), as being anticipated by U.S. Patent No. 6,658,590, Sicola, *et al.* (hereinafter "Sicola"). Applicants respectfully traverse each of these rejections. For purposes of clarity in the discussion below, the respective related claim sets are discussed separately.

IA.     Rejection of Claims 1-4, 9, and 10 under 35 U.S.C. §102(e):

Claims 1-4, 9, and 10 are directed to a method that is practiced in a storage network. Performance of the method updates a first replica held by a physically remote device in the storage network. The method includes steps of instructing a first data replication facility of a first electronic device in the storage network to log one or more writes to a local storage device when the first replica held by the physically remote storage device cannot be updated due to a detected error condition in the storage network. In accordance with the recited method, the first electronic device further determines if the detected error condition still exists in the storage network that prevents updating of the first replica held by the physically remote storage device. The method further includes a step of instructing the first data replication facility of the first electronic device to replicate data corresponding to the one or more writes identified in the log to generate a second replica upon the determination by the first electronic device that the first replica held by the physically remote storage device can be upgraded due to a removal of the detected error condition.

The second replica is outputted from the first electronic device in accordance with a communication protocol to a second data replication facility of the second electronic device of the physically remote storage device in the storage network to update the first replica. The Sicola reference does not anticipate Claims 1-4, 9, and 10.

Sicola teaches the use of remote copy sets. A remote copy set as defined by Sicola is the pairing of volumes between a local storage array and a remote storage array. The pairing of a local volume and a remote volume is referred to throughout Sicola as a "remote copy set". Sicola defines a remote copy set as consisting of two same sized volumes, one on the local array, and one on the remote array. *See*, column 8, lines 59-61 of Sicola. Sicola further teaches that when all links between local and remote storage sites are down, or when the remote pair of array controllers are inoperative and the remote storage array is inaccessible to the local site then write operations from the local host are directed to both a local storage array and a log unit. *See*, Column 14, lines 12-29 of Sicola.

During the remote outage, Sicola teaches that extents and data from the local site are both written to a log unit associated with the local site. When access to the remote site is restored, the log unit is "replayed" to the remote site. Replaying the log, sends all commands and data to the remote site "partner" in the original transaction order to all remote copy sets associated with the log unit. A merging operation is performed by the system of Sicola to return a remote copy set (both local and remote members) to the same data state after link restoration or remote site restoration. A "mergeback" operation is performed by the system of Sicola to restore the local site back to the same state as the remote site during site fail back. A local log and a remote log are used to replay the transactions for the merge and mergeback functions, respectively. *See*, Column 14, lines 44-59 of Sicola.

Nevertheless, Sicola does not perform a step of instructing the first data replication facility of the first electronic device to *replicate* data corresponding to the one or more writes identified in the log to *generate a second replica* upon determination by the first electronic device that the first replica held by the physically remote storage device can be updated due to a removal of the detected error condition. More specifically, Sicola <u>does not</u> generate a second replica upon determination by the first electronic device that the first replica held by the physically remote storage device can be

14

updated due to a removal of the detected error condition. The replay operation disclosed by Sicola does not generate a second replica. Rather, the replay operation of Sicola performs a first-in-first-out queuing operation so that the upon re-establishment of communication to the remote site, data in the log is read from and queued in a first-in-first-out manner to return a remote copy site (both local and remote members) to the same data state.

In contrast to Sicola, Claims 1-4, 9, and 10 recite a step of instructing the first data replication facility of the first electronic device to replicate data corresponding to the one or more writes identified in a log to generate a second replica upon determination by a first electronic device that the first replica held by the physically remote storage device can be updated to a removal of the detected error condition that prevents updating of the first replica held by the physically remote storage device. Nowhere does Sicola disclose the generation of a second replica by replicating data corresponding to one or more writes identified in a log. Sicola is concerned with queuing logged data to replay the logged data in a manner similar to the well know use of "instant reply" used to replay a portion of a sporting event. Replaying the log as taught by Sicola does not mean or equate to replicating data in the log to generate a second replica. Replaying the log as taught by Sicola means or equates to the emptying of the log in a first-in-first-out much like emptying a FIFO buffer. In fact, Sicola discloses that even after re-establishment of communications with the remote site the local site continues to write to the log, but the host writes are delayed to allow the merge to catch up to the log writes. More specifically, a "command throttle" routine is executed to slow down host writes so the merge can take place. See, Column 15, line 22-24 of Sicola. That is, Sicola teaches the use of the log as a FIFO buffer. In this manner, when communication to the remote site is restored the buffer or log is emptied in a controlled fashion without the need to replicate data corresponding to one or more writes identified in a log to generate a second replica.

Hence, the Sicola reference discloses a storage network architecture, function, and operation, distinct from that of the claimed invention. The Sicola patent, hence, does not anticipate the method to update a first replica held by a physically remote storage device in a storage network as recited in Claims 1-4, 9, and 10.

Accordingly, Applicants respectfully request the Examiner to reconsider and withdraw the rejection of Claims 1-4, 9, and 10 under 35 U.S.C. §102(e).

IB.     Rejection of Claims 13, 14, 16, and 17 under 35 U.S.C. §102(e)

Claims 13, 14, 16, and 17 stand rejected under 35 U.S.C. §102(e) as being anticipated by Sicola. Applicants respectfully traverse this rejection for the following reasons.

Claims 13, 14, 16, and 17 are directed to a method to handle a communication link failure in a computer network. The computer network includes a number of programmable electronic devices, and each of the programmable electronic devices operates as a host device for a data replication facility for replicating data amongst the programmable electronic devices. The method includes a step of instructing each data replication facility of each programmable electronic device to enter a logging routine should the host device of the data replication facility detect the communication link failure. The method further includes a step of instructing each data replication facility of each programmable electronic device that initiated the logging routine to generate a replica for each local write identified in the log upon re-establishment of the communication link.

Claims 13, 14, 16, and 17 are not anticipated by Sicola. Sicola does not disclose a step of instructing *each* data replication facility of *each* of the *plurality of programmable* electronic devices to enter a logging routine should a host device of the data replication facility detect a communication link failure. Sicola is concerned with logging write operations on a <u>single</u> host when <u>two</u> communication link failures occur. Nowhere does Sicola disclose instructing *each* data replication facility of *each* of the *plurality of programmable* electronic devices to enter a logging routine upon determination of a link failure. In contrast, the method of Claims 13, 14, 16, and 17 instruct each data replication facility of each of the plurality of the programmable electronic devices to enter a logging routine should a host device of the data replication facility detect a communication link failure.

Hence, the storage area network of Sicola has a structure and an operation and a function, different from that of the claimed invention. The Sicola patent, hence does not anticipate the method recited in Claims 13, 14, 16, and 17.

Accordingly, Applicants respectfully request the Examiner to reconsider and withdraw the rejection of Claims 13, 14, 16, and 17 under 35 U.S.C. §102(e).

IC.    Rejection of Claims 19-22 and 27-29 under 35 U.S.C. §102(e)


Claims 19-22 and 27-29 stand rejected under 35 U.S.C. §102(e) as being anticipated by Sicola. Applicants respectfully traverse this rejection based on the following comments.

Claims 19-24 and 27-29 are directed to a readable medium holding programmable electronic device readable instructions to perform a method in a storage network to update a first replica held by a physically remote storage device in the storage network. The medium includes instructions to instruct a first data replication facility of a first programmable electronic device in the storage network to enter a first state to log one or more writes to a local storage device when the first replica held by the physically remote storage device cannot be updated due to a detected error condition that does not allow transmission of data to the physically remote storage device. The medium further includes instructions to determine at the first programmable electronic device if the first replica held by the physically remote storage device can be updated due to an abatement of the detected error condition. The medium includes instructions to instruct the first data replication facility of the first programmable electronic device to replicate data corresponding to the one or more writes identified in the log in order to create a second replica upon determination by the first programmable electronic device that the first replica held by the physically remote storage device can be updated. Further instructions held by the medium outputs the second replica in accordance with a communication protocol from the first programmable electronic device to a second data replication facility of a second programmable electronic device in communication with the physically remote storage device in the storage network to update the first replica.

The Sicola reference does not anticipate Claims 19-22 and 27-29. Nowhere does Sicola disclose the generation of a second replica by replicating data corresponding to one or more writes identified in a log. Sicola is concerned with queuing logged data to replay the logged data in a manner similar to the well know use of "instant reply" used to replay a portion of a sporting event. Replaying the log as taught by Sicola does not mean or equate to replicating data in the log to generate a second replica. Replaying the log as taught by Sicola means or equates to the emptying of a first-in-first-out buffer or queue. In fact, Sicola discloses that even after re-establishment of communications with the remote site the local site continues to write to the log, but the host writes

17

are delayed to allow the merge to catch up to the log writes. More specifically, a "command throttle" routine is executed to slow down host writes so the merge can take place. *See*, Column 15, line 22-24 of Sicola. Sicola discloses the use of the log as a first-in-first-out buffer and does not disclose replication of the data corresponding to writes held by the log.

The Sicola patent, hence does not anticipate Claims 19-22 and 27-29. Accordingly, Applicants respectfully request the Examiner to reconsider and withdraw the rejection of Claims 19-22 and 27-29 under 35 U.S.C. §102(e).

## CLAIM REJECTIONS UNDER 35 U.S.C. §103

Claims 8, 12, 15, and 26 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Sicola in view of U.S. Patent No. 5,909,540 of Carter, et al. Applicants respectfully traverse each of these rejections. For purposes of clarity in the discussion below, the respective related Claim sets are discussed separately.

IIA.    Rejection of Claims 6 and 8 under 35 U.S.C. §103(a)

Claims 6 and 8 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Sicola in view of U.S. Patent No. 5,909,540 of Carter, et al. (hereinafter "Carter"). Applications respectfully traverse this rejection in view of the following arguments.

Claims 6 and 8 depend, directly or indirectly, from Claim 1 and, hereby, incorporate the novel features of independent Claim 1. As discussed above, in connection the Claim rejections under 35 U.S.C. §102, the Sicola patent does not anticipate Claim 1.

The Carter patent is directed to a network having an interface to a globally addressable memory system that provides persistent storage of data exchange connectivity information. The exchange connectivity information provides information regarding node failures to other nodes in the network, and the surviving nodes use the information to determine which node, if any, has ceased functioning. Various processes are used to recover the portion of the global address space

for which the failure node was responsible, including RAM directory, DIS directory, or file system information.

The Carter reference is not concerned with data replication. In fact, the Carter reference teaches away from data replication. *See,* Column 2, line 52-64 of Carter. Hence, the Carter reference fails to bridge the factual deficiencies of the Sicola reference, and accordingly, neither the Sicola nor the Carter reference, alone or in combination, teach or suggest each and every element recited in Claims 6 and 8.

The Sicola reference, in view of the Carter reference, fails to establish a *prima facie case* of obviousness with which to reject Claims 6 and 8. Neither the Sicola reference nor the Carter reference, alone or in combination, teach or suggest each and every element of the rejected Claims. Moreover because Carter teaches away from replication, there is no suggestion or motivation to combine the two references. Hence, Claims 6 and 8 are not obviated by Sicola or by Carter, alone or combination. Applicants therefore respectfully request the Examiner to reconsider and withdraw the rejection of Claims 6 and 8under 35 U.S.C. §103.


IIB.    Rejection of Claim 15 under 35 U.S.C. §103(a)


Claim 15 stands rejected under 35 U.S.C. §103(a) as being unpatentable over Sicola in view of Carter. Applicants respectfully traverse this rejection in view of the comments below.

Claim 15 depends directly, or indirectly, from independent Claim 13 and, thereby, incorporates the novel features of Claim13.

Claim 15 is not rendered unpatentable over Sicola in view of Carter. As discussed above, in connection with the rejection of Claim 13 under 35 U.S.C. §102, Sicola does not disclose each and every element of Claim 13.

The Carter reference is not concerned with data replication. In fact, the Carter reference teaches away from data replication. *See,* Column 2, line 52-64 of Carter. Hence, the Carter reference fails to bridge the factual deficiencies of the Sicola reference, and accordingly, neither the Sicola nor the Carter reference, alone or in combination, teach or suggest each and every element recited in Claim 15.

The Sicola reference, in view of the Carter reference, fails to establish a *prima facie case* of obviousness with which to reject Claim 15. Neither the Sicola reference nor the Carter reference, alone or in combination, teach or suggest each and every element of the rejected Claims. Moreover because Carter teaches away from replication, there is no suggestion or motivation to combine the two references. Hence, Claim 15 is not obviated by Sicola or by Carter, alone or combination. Applicants therefore respectfully request the Examiner to reconsider and withdraw the rejection of Claim 15 under 35 U.S.C. §103.

IIC.    Rejection of Claim 26 under 35 U.S.C. §103(a)

Claim 26 stand rejected under U.S.C. §103(a) as being unpatentable over Sicola in view of Carter. Applicants respectfully traverse this rejection based on the following arguments.

Claim 26 depends, directly or indirectly, upon independent Claim 19 and, thereby, incorporate the novel features of Claim 19.

Claim 26 is not rendered unpatentable over Sicola in view of Carter. As discussed above, in connection with the rejection of Claim 19 under 35 U.S.C. 102, the Sicola patent does not disclose each and every element of Claim 19.

The Carter reference is not concerned with data replication. In fact, the Carter reference teaches away from data replication. *See,* Column 2, line 52-64 of Carter. Hence, the Carter reference fails to bridge the factual deficiencies of the Sicola reference, and accordingly, neither the Sicola nor the Carter reference, alone or in combination, teach or suggest each and every element recited in Claim 26.

The Sicola reference, in view of the Carter reference, fails to establish a *prima facie* case of obviousness with which to reject Claim 26. Neither the Sicola reference nor the Carter reference, alone or in combination, teach or suggest each and every element of the rejected Claim. Moreover, because Carter teaches away from replication, there is no suggestion or motivation to combine the two references. Hence, Claim 26 is not obviated by Sicola or by Carter, alone or combination. Applicants therefore respectfully request the Examiner to reconsider and withdraw the rejection of Claim 26 under 35 U.S.C. §103.

20

## New Claim 31

New Claim 31 is not anticipated by nor is it rendered obvious by the cited references either alone or in combination. Specifically, each cited reference fails to disclose, teach or suggest a method performed in a storage network to update a first replica held by a physically remote storage device in the storage network that includes a step of instructing said first replication facility of said first electronic device to halt logging of said one or more writes to said local storage device upon said determination that said first replica can be updated. Accordingly, new Claim 31 is patentably distinct from each of the cited references either alone or in any combination.

## CONCLUSION

In view of the remarks set forth above, Applicants' contend that Claims 1-31 presently pending in this application, are patentable and in condition for allowance. If the Examiner deems there are any remaining issues, we invite the Examiner to call the undersigned at (617) 227-7400. Applicants believe no fee is due with this statement. However, if a fee is due, please charge our Deposit Account No. 12-0080, under Order No. SMQ-082CN2 from which the undersigned is authorized to draw.

Dated: July 1, 2004                              Respectfully submitted,

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